Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Polymer Nanocomposites Made with Unmodified Graphite or Carbon Nanotubes: Role of Dispersion in Optimizing Mechanical and Thermal Properties and Electrical Conductivity JUNICHI MASUDA, KATSUYUKI WAKABAYASHI, PHILIP BRUNNER, CYNTHIA PIERRE, JOHN TORKELSON, Northwestern University — Polymer nanocomposites made with carbon-based nanofiller have the potential to achieve unprecedented, multifunctional property enhancements in comparison with other nanocomposite systems. Here, we describe research in which we prepare nanocomposites with polymers that are not amenable to solution-based processing, such as polypropylene and poly(ethylene terephthalate). Solid-state shear pulverization is used singly or in conjunction with melt processing to obtain well-dispersed polymer/graphite and polymer/carbon nanotube nanocomposites. We report record improvements in properties of unoriented films of polypropylene nanocomposites, including Young's modulus, crystallization rate, and thermal degradation temperature. We also characterize electrical conductivity of such nanocomposites and note that the dispersion characteristics necessary to achieve maximum mechanical and thermal properties differ from those needed to maximize electrical conductivity. The potential of and challenges with using unmodified graphite as a filler in polymer nanocomposites will be discussed.

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Date submitted: 21 Nov 2008 Electronic form version 1.4